

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1, 2, 3 and 5 are presently active in this case, Claim 1 having been amended and Claim 6 cancelled by way of the present amendment.

In the outstanding Official Action, Claims 1, 2, 5 and 6 were rejected under 35 USC 103 as being unpatentable over U.S. Patent 4,281,550 to Erikson or U.S. Patent 3,587,561 to Ziedonis in view of U.S. Patent 4,211,949 to Brisken et al combined with U.S. Patent 4,344,327 to Yoshikawa et al or U.S. Patent 4,409,982 to Plessset et al. Claim 3 was finally rejected under 35 USC 103 as being unpatentable over the above-noted references, in further view of U.S. Patent 4,479,069 to Miller or U.S. Patent 4,404,489 to Larson.

The above change to the specification is made to correct an obvious informality uncovered during review of the application in preparation of the present amendment. Therefore, this change is not believed to raise a question of new matter.

In response to the rejection on the merits, Claim 1 has been amended to include the limitations previously stated in Claim 6, and further to clarify that the groove defining the individual transducer

elements also extend into a portion of the flexible backing plate. Antecedent basis for this latter change to Claim 1 is found in Applicant's originally filed specification at page 9, lines 9-12 and page 11, lines 7-15. Accordingly, these changes are not believed to raise a question of new matter.

Next, it is noted that the present amendment is made in accordance with the provisions of 37 CFR 1.116 which states that amendments placing the claims in better form for consideration on appeal may be made after final rejection. Since the above amendment combines Claim 1 and further clarifies Applicant's contribution to the art, it is respectfully submitted that the present amendment places Applicant's claims in better form for consideration on appeal. It is respectfully requested that the 37 CFR 1.116 be liberally construed, and that the present amendment be entered.

Recapitulating, Applicant's invention is directed to an a new and improved ultrasonic transducer having a convex surface and various attendant distinguishing features. One feature is that the flexible backing plate of Applicant's invention is mounted on a convex backing base. The flexible backing base has a plurality of grooves which render the flexible backing plate even further flexible and facilitates bending and mounting of the flexible backing plate on the convex surface of the backing base of the invention.

It is another feature of Applicant's invention that the backing plate 2 has the same acoustic impedance as the backing base 3, and adheres thereto by means of an adhesive layer 1 in the form of an epoxy resin containing heavy metal powder to match the acoustic impedance of the adhesive layer 1 with the backing base 3 and the backing plate 2. This matching of the acoustic impedance contributes to preventing ultrasonic wave propagating towards the backing base 3 from being reflected at such a connection layer, as specifically taught at page 6, lines 7-19, of Applicant's specification.

In contrast to Applicant's invention, the applied patent to Erikson discloses a transducer array in which a plurality of grooves are formed only partly through the piezoelectric ceramic and in which the individual transducer elements are then further formed by cracking of the remaining portion of the piezoelectric layer. The "cracked" transducer elements are retained in place by front electrode 605 and window 615 (column 6, lines 17-20).

Several immediate evident differences exist between Applicant's invention and Erikson. Clearly, Erikson does not teach cutting a groove completely through transducer elements and a portion of a flexible backing layer, and the "cracking" technique taught by Erikson at best results in the irregularly shaped

transducers characterized by correspondingly irregular radiation patterns. Further, if it is considered that the flexible matching window 615 taught by Erikson corresponds to the flexible backing plate of Applicant's invention, nevertheless, Erikson does not teach the provision of a base having a curvilinear surface, as taught by Applicant's, and does not teach the provision of a flexible backing plate having an acoustic impedance the same as that of the curvilinear base bonded thereto with an epoxy containing heavy metal powder to match the acoustic impedance of the base to the backing plate. Accordingly, it is respectfully submitted that Applicant's invention clearly patentably distinguishes over the Erikson patent.

Ziedonis is similarly deficient in failing to teach the provision of grooves of any kind, and in failing to teach the provision of a transducer assembly formed of individual transducers formed on a flexible backing plate adhesively bonded to a curvilinear base. Thus, Ziedonis does not disclose provision of grooves cutting through a portion of a flexible backing plate and does not teach the acoustic matching of a flexible backing plate to a base by means of the adhesive as recited in amended Claim 1. Indeed, Ziedonis in no cures the deficiencies above-noted in the Erikson patent, and Applicant's invention is believed to be patentably distinguishing thereover.

Brisken et al '949 discloses a linear transducer array covered by a contacting wear plate made of silicone rubber or polyurethane epoxy. As shown in Figure 4, the Brisken et al '949 transducer elements include piezoelectric layer 21 having opposed electrode layers 22 applied thereto, mounted atop matching layers 23 and 24 formed on a mylar layer 25 on top of the wear layer 12. Individual transducers are separated by "grooves", which do not, however, extend into either the mylar layer 25 or the wear layer 12. Further, Brisken et al '949 in no way suggests the provision of a base and flexible backing plate combination as stated in amended Claim 1, and indeed Brisken et al '949 does not even appear to teach any structure corresponding to the Applicant's base. In this regard, it should be noted that Applicant specifically teaches impedance matching on both sides of the transducer element, whereas this teaching appears to be quite lacking from each of the Erikson, Ziedonis and Brisken et al patents. Accordingly, Applicant's invention as recited in amended Claim 1 is believed patentably distinguishing over these references.

The Yoshikawa et al and Plessset et al patents were cited for the teaching providing convex transducers, versus the concave transducers taught by Erikson and Ziedonis. However, even if it is assumed that the provision of a convex transducer is per se obvious,

Yoshikawa et al and Plessset et al fail to cure the other deficiencies above noted in the Erikson, Ziedonis and Brisken et al '949 patents. Therefore, it is respectfully submitted that Applicant's invention as recited in the claims patentably distinguishes thereover.

The remaining references of record have also been considered.

U.S. Patent 3,496,617 to Cook et al discloses a convex transducer array including diced piezoelectric crystal 11, electrode 12 and epoxy backing sheet 13. However, the grooves separating the individual transducer elements as taught by Cook et al likewise do not extend into a flexible backing plate as taught by Applicant's, and in fact Cook et al reinforce the erroneous transducer "cracking" teaching provided by Erikson. Further Cook et al do not teach the provision of a acoustically matched base and flexible backing plate as recited in amended Claim 1.

On the other hand, U.S. Patent 4,385,255 to Yamaguchi et al discloses a linear array ultrasonic transducer in which individual transducer elements are separated by grooves extending into "a backing member (or an ultrasonic absorber) 2 made of rubber mixed with metal powders" (column 3, lines 15-16). However, the Yamaguchi et al backing member 2 does not appear to be flexible, and Yamaguchi et al do not appear to teach

structure corresponding to the base/flexible backing plate of Applicant's invention. Thus, Yamaguchi et al do not teach the acoustic matching between the base/adhesive/flexible backing plate taught by Yamaguchi et al Applicant as recited in amended Claim 1.

The remaining references of record are believed to be less pertinent than the references above discussed, and in view of the deficiencies in the references of record, it is respectfully submitted that amended Claim 1 and dependent Claims 2, 3 and 5 patentably distinguish thereover.

Also, attached hereto are sales brochures indicating commercialization of the curvilinear array of ultrasonic transducers according to the presently claimed invention. These sales brochures are submitted in order to demonstrate that the present invention surely is non-trivial and is being commercialized. The present invention has been well received, and is believed to represent a distinct improvement over the conventional transducer probes previously available. The undersigned is also in possession of actual samples of the curvilinear array of the invention, in various stages of fabrication, and would be happy to show these samples to the Examiner upon request. In the event that the Examiner would like to see the samples, or in the event that the Examiner has any further suggestions for advancing the issues in this application, the

Examiner is invited and encouraged to contact the undersigned by telephone for that purpose.

In view of the above discussion, it is respectfully submitted that the claims of Applicant's invention are in condition for formal allowance, and an early and favorable Action to that effect is respectfully requested.

Respectfully submitted,

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